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Length–weight relationship, condition factor and fecundity of *Clarias gariepinus* (Burchell, 1822) from Epe lagoon, Lagos state, Nigeria.

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Abstract

This study was carried out to determine the performance of wild African catfish *Clarias gariepinus* and its impact on fish parameters from natural habitat. Gill netted fish samples were collected from artisanal fishermen at landing site in the study area. Standard techniques of length-weight measurement, length-weight relationship coefficient, gonado-somatic indices (GSI), sex ratio and fecundity were used in statistical analysis of data obtained which were graphically represented for separate and both sexes. Length of species ranged 20.10-26.50cm and weight 50.20-134.00g. Length weight relationship indicated allometric growth for male (2.992; r^2=0.8031); female (2.857; r^2=0.8929) with an isometric growth for both sexes (3.017; r^2=0.823). Sex ratio 2:1 (male : female), mean GSI in gravid females was 3.72% with fecundity 3529.5 and condition factor revealed extremely poor well-being status (k=0.65) for both sexes. Management intervention in the study area is inevitable in order to protect the dwindling performance of *C. gariepinus*.

Keywords: Allometric, Fecundity, Isometric. Lagoon

1. Introduction

Assessment of fish stock in natural environment assists biologist and environmentalist in understanding species performance in the water body (Falaye, Opadokun and Ajani, 2015). These assessments has led to various developed models used in understanding the relationships that exist among parameters that interprets the environment in which species reside before been caught in the food chain for use by different species in different niches in the pyramid of energy.

Length weight relationships, condition factor and fecundity has been studied and used as a tool in growth determination of species in freshwater, brackish water and marine environment Olurin and Savage (2011), Fafioye and Oluajo (2005), Ogunola, Onada, Falaye and Kunzmann, (2017), Nehemia, Maganira and Rumisha, (2012). The relationships are important in setting management and extractive standards for species (Anene, 2005); in

species population dynamics (Kolher*et al.,* 1995) and indicating how well the species fared in the environment (Petrakis and Stergiou, 1995). The state of well-being is paramount to the biologist (Barnham and Baxter (1998); Olurin and Aderibigbe (2006) as it indicates species relationship to physiological stages of life in ecosystem equilibrium dynamics (Imam, Bala, Balarabe and Oyeyi, 2010).

The African mud catfish (*Clariasgariepinus)* dominates the aquaculture production business and fresh fish marketing sector in Nigeria (Durojaiye and Sule, 2018), this owes to the fast growth rate exhibited by the species. However, obtaining in nature an appreciable market size weight has been linked to environmental factors, anthropogenic activities and over exploitation of wild species (Fafioye and Oluajo (2005). The Epe lagoon, Lagos State, Nigeria is an important landing centre for commercially important freshwater fishes which include *C. gariepinus*. In spite of good landing; no convincing information is available on the growth performance and other related information on this fish. This research thus aimed at determining the length-weight relationship, condition factor, fecundity, gonado-somatic-index and sex ratio of (*C. gariepinus)* from Epe Lagoon as related studies dealt with fish species combination.

2. Materials and Methods
2.1. Description of the study area
Epe lagoon lies between latitudes latitudes 6^0 23'N and 6^0 41'N and Longitudes 2^0 42'E and 3^0 42'E and is fed by River Oshun.

2.2. Collection of fish samples
Eighty fish samples (80) were collected for the research with the help of local fishermen. Samples were stored in coolers containing ice and transported to the laboratory of Department of Fisheries Management College of Agricultural Sciences, Olabisi Onabanjo University for further investigation.

2.3. Laboratory techniques
Length measurements were carried out using Measuring Board (cm), the length was measured from the tip of the Snout to the tip of the caudal fin, while weight was taken, using an electronic weighing balance (g) after the removal of excess water from the body surfaces. Data generated was subjected to length – weight relationship: $W = aL^b$ (Schneider *et al.,* 2000) and values of constants a and b was estimated after logarithmic transformation values of length and weight i.e.
Log W = log a + b log L (Zar, 1984) using linear regression analysis. While Fulton's Condition Factor (K) = $100W/L^3$ (Ikomi and Odun, 1998).
Fecundity of each specimen was achieved by dissection and their gonads removed, rinsed and placed in a 10% buffer formalin solution. The sex of each specimen was identified by visual examination of the gonads (Ugwumba *et al.,* 1991). Then, the mean value of eggs counted was used to calculate the total number of eggs in the gonad. Gonado Somatic Index (GSI) = (Weight of gonad / Weight of fish)*100.

2.4. Statistical analysis
Data from length-weight measurement, condition factor, fecundity, gonado-somatic-index and sex ratio were analyzed statistically using descriptive statistics and level of association with respect to length–weight was subjected to correlation and regression analysis with Microsoft Excel package.

3. Results and Discussions

3.1. Length-weight measurement

The total number of *C. gariepinus* fish from Epe Lagoon (Table 1) collected was eighty with twenty-six females and fifty-four males; the total length of the fish ranges from 20.10cm-26.50cm with a mean length of 23.68±1.76cm while the weight ranges from 50.20g – 134.00g with a mean weight of 84.45±21.18g. The female fish had the highest mean length as well as weight. The sex ratio was 1:2 in favor of the males, showing an evidence of polyandry and similar to Opadokun and Ajani (2015) report of sex ratio of 1:1.8 for *Gymnarchusniloticus*,

Table 1: Ranges and mean values of length and weight of *C. gariepinus* from Epe Lagoon.

Sex	No. of Fish	Sex Ratio	Length Range (cm)	Mean Length (g) S.D	Weight Range (g)	Mean Weight (g) S.D
Female	26	1	20.10 - 26.50	24.08 ± 3.77	50.20 – 112.20	92.82 ± 19.50
Male	54	2	20.30 – 26.40	23.49 ± 1.71	55.60 - 134.00	80.42 ± 21.10
Total	80		20.10 – 26.50	23.68 ± 1.76	50.20 – 134.00	84.45 ± 21.18

3.2. Length-weight relationship

Table 2 showed the values of the regression constant of the length-weight relationship of both the female and the male *C.gariepinus*. The values were significantly ($p > 0.05$) lower than 3 in both female and male *C. gariepinus*. These showed that the fish exhibited a negative allometric growth. A high degree of positive correlation between total length and total weight of all organisms was indicated by high values of correlation coefficient (r) indicating that species size increase in accordance with weight and length increase and this corroborates Ogunola *et al.,* (2018) for *H. odoe.*

Table 2: Length-weight relationship coefficient and condition factor of *C. gariepinus* from Epe lagoon.

Sex	N	Regression Coefficient				Correlation Coefficient		K- values
		a	SE	b	SE	R^2	R	
Female	26	2.857 ± 0.29		-1.987 ± 0.41		0.892	0.944	0.70
Male	54	2.992 ± 0.29		-2.207 ± 0.41		0.803	0.896	0.60
Total	80	3.017 ± 0.23		-2.230 ± 0.31		0.823	0.907	0.65

In this study, *C. gariepinus* found in Epe lagoon showed negative allometric growth pattern. This corroborates with the findings of Fafioye and Oluajo (2005) who reported negative allometric growth pattern for *C. gariepinus* in the same study area. The values of b in female, male and both sexes were -1.987, -2.207 and -2.230 respectively. This showed that the rate of increase in body length is not proportional to the rate of increase in the body weight. This is a negative allometric growth and it is similar to b values of 2.911 and 2.880 recorded for *C. Gariepinus* (King, 1996) and (Fafioye, 2005) and Falaye, *et al.,* (2015) for *Gymnarchusniloticus*, respectively. While isometric growth was observed in combined sexes and this is similar to the findings of Olanrewaju *et al.,* (2017) for *Parachanobscura* and Olopade *et al.,* (2018) for *S. galilaeus*. The r value for female and combined sexes is similar to Fafioye and Oluajo (2005).

The differences in the weight of all the samples may be due to the individual condition factor (k value) as it relates to the well-being and degree of fitness of fish (Pauly, 1983). The k value of the female, male and both sexes are 0.70; 0.60 and 0.65 respectively. These

values are lesser than values (2.9 to 4.8) documented by Bagenal and Tesch (1978) for mature fresh water fish body weight, but similar to Fafioye and Oluajo (2005) for *C. Gariepinus* and Falaye, *et al.,* (2015) for *Gymnarchusniloticus* and both reported low K value which indicated threatened habitat and well-being of the fish which is similar to that reported for this study.
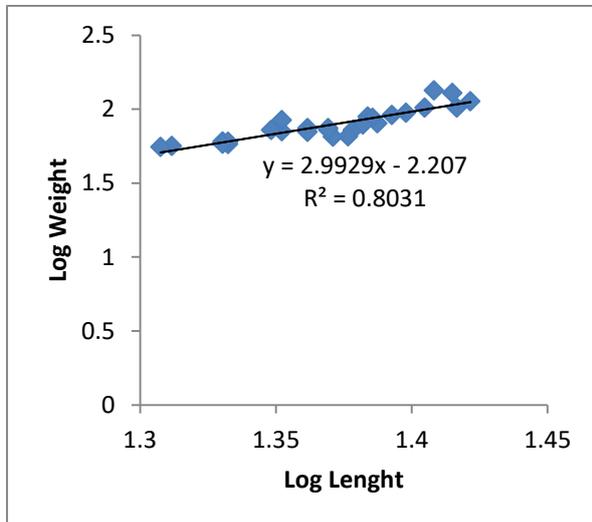

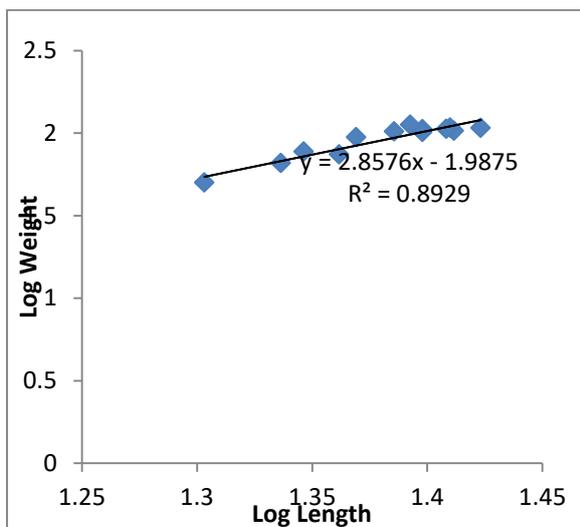Fig. 1: Length-weight relationship of male *C. gariepinus* from Epe lagoon.

Fig. 2: Length-weight relationship of female *C. gariepinus* from Epe lagoon.

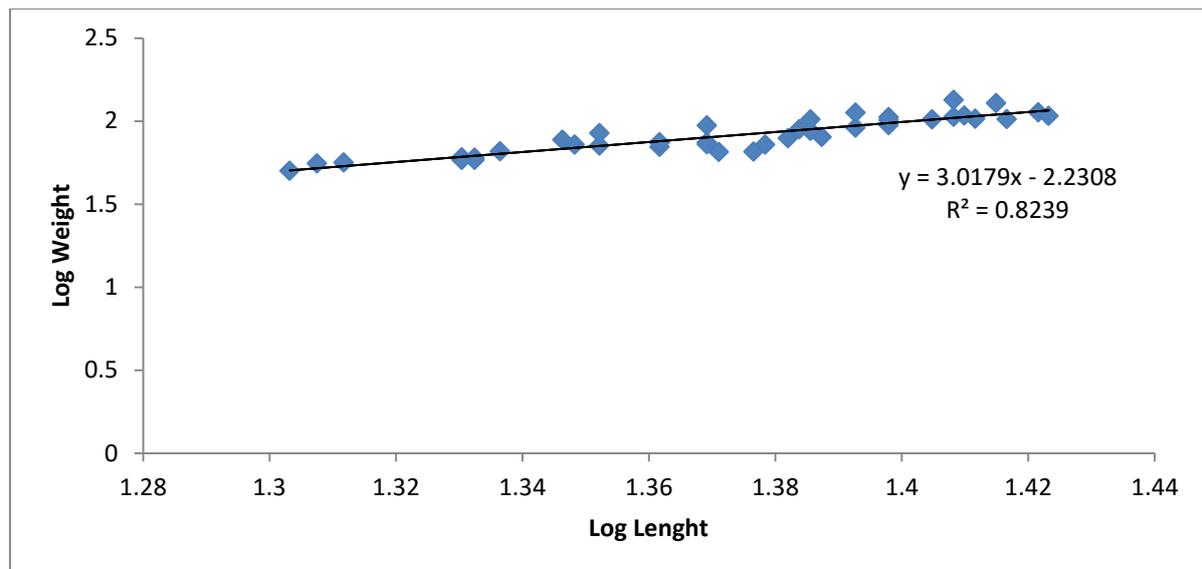*Sule et al., Length-weight relationship…*

Fig. 3: Length-weight relationship of both sexes of *C. gariepinus* from Epe lagoon.

3.3. Fecundity

Table 3 showed morphometric parameters of female *C. gariepinus* from Epe Lagoon. The mean gonado-somatic Index was 3.72%. The number of eggs from ovary of the eight gravid females and weight showed that there was an increase in fecundity as weight increased.

Table 3: Morphometric parameters of gravid female *C. gariepinus* from Epe Lagoon

	Minimum	Maximum	Mean±SD
Fecundity	2813	4246	3529.5±818.05
Weight (g)	107.3	107.8	107.55±2.85
Length (cm)	25.70	26.50	26.10±0.99
K value	0.50	0.60	0.60±0.01
GSI (%)	2.60	4.85	3.72±0.05

The gravid female in this research was similar in number relative to sample size reported by Olurin and Savage (2011) of 14 gravid female from 75 fish samples while the eggs of *P. obsura* falls within range reported by this study. Opadokun and Ajani (2015) reported fecundity ranged between 750 and 1,291 eggs with mean value 925.61 in females of standard length 63.00-130.50cm suggesting that the females had low fecundity. The minimum fecundity in this study was similar to the highest in Olurin and Savage (2011). The GSI in this study of 2.60-4.85 were higher than Opadokun and Ajani (2015) while male gonads weight was not sensitive enough on the scale and this was also observed by Olurin and Savage (2011). The R^2 in this study (Figures 4 and 5) for fecundity–weight and fecundity-length was similar to the findings of Idowu (2017) who obtained R^2 of 0.6852 and 0.5481 respectively for *H. odoe* from a reservoir. Deduction from the result indicated that female *C. Gariepinus* were scarce, due to the fact that samples were collected during their spawning season. Of all the 26 female only eight were gravid. Maturity stages of the fish were observed and the eight females were in the last stage of egg development, while the remaining eighteen might have spawned their eggs for fertilization.
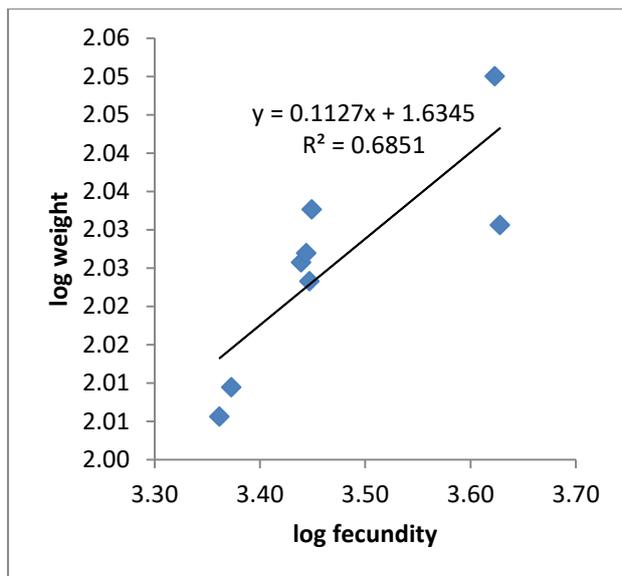
Fig. 4: Fecundity-weight relationship of gravid sex *C. gariepinus* from Epe lagoon.
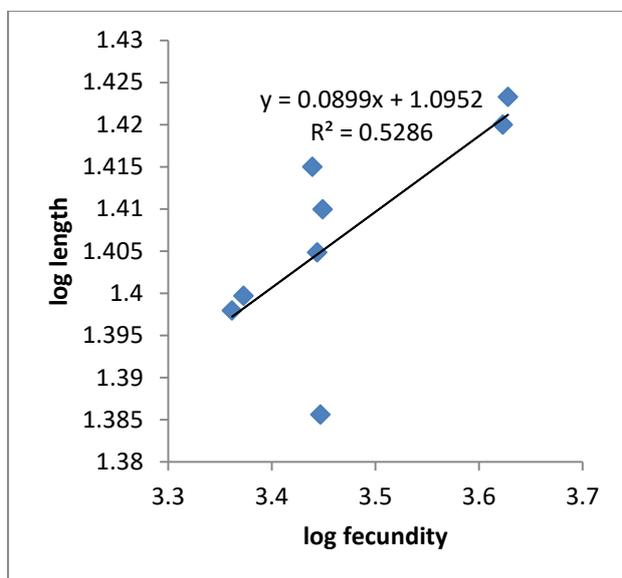

Fig. 5: Fecundity-length relationship of gravid sex *C. gariepinus* from Epe lagoon.

4. Conclusion

The length-weight of *Clarias gariepinus* showed that there is a positive correlation between length and the weight of both sexes; however the condition factor revealed that the specie is extremely in poor condition. The effect of anthropogenic activities on the specie had impacted negatively on the specie as the water body receives effluent laden water from inland water (River Oshun) for onward discharge into the ocean.

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